CAT 2021 SHIFT-1 QUESTION PAPER

Time Allowed: 2 Hours **Maximum Marks: 198**

Important Instructions

(i) Total Number of Questions: 66
(ii) Number of Question in Verbal Ability and Reading Comprehension (VARC): 24
(iii) Number of Question in Data Interpretation and Logical Reasoning (DILR): 20
(iv) Number of Question in Quantitative Ability (QA): 22
(v) 40 Minutes are allotted to attempt each section.
(vi) 4 answer options for each MCQ type question
(vii) Answers are typed in the given space on the computer screen for Non-MCQ.
(viii) For each correct answer: +3 marks
(ix) Negative marking (Applicable for wrong answers in MCQs): –1 mark

Verbal Ability and Reading Comprehension (VARC)

Passage 1

Directions (Q. 1 to 4): *The passage below is accompanied by a set of questions. Choose the best answer to each question.*

Cuttlefish are full of personality, as behavioural ecologist Alexandra Schnell found out while researching the cephalopod's potential to display self-control,.., ''Self-control is thought to be the cornerstone of intelligence, as it is an important prerequisite for complex decision-making and planning for the future," says Schnell...

[Schnell's] study used a modified version of the "marshmallow test"... During the original marshmalow test, psychologist Walter Mischel presented children between age four and six with one marshmalow. He told them that if they waited 15 minutes and didn't eat it, he would give them a second marshmalow. A long-term follow-up study showed that the children who waited for the second marshmallow had more success later in life.... The cuttlefish version of the experiment looked a lot different. The researchers worked with six cuttlefish under nine months old and presented them with seafood instead of sweets. (Preliminary experiments showed that cuttlefishes' favourite food is live grass shrimp, while raw prawns are so-so and Asian shore crab is nearly unacceptable.) Since the researchers couldn't explain to the cuttlefish that they would need to wait for their shrimp, they trained them to recognize certain shapes that indicated when a food item would become available. The symbols were pasted on transparent drawers so that the cuttlefish could see the food that was stored inside. One drawer, labelled with a circle to mean "immediate," held raw king prawn. Another drawer, labelled with a triangle to mean "delayed." held live grass shrimp. During a control experiment, square labels meant "never.'

"If their self-control is flexible and I hadn't just trained them to wait in any context, you would expect the cuttlefish to take the immediate reward [in the control], even if it's their second preference," says Schnell... and that's what they did. That showed the researchers that cuttlefish wouldn't reject the prawns if it was the only food available. In the experimental trials, the cuttlefish didn't jump on the prawns if the live grass shrimp were labelled with a triangle— many waited for the shrimp drawer to open up. Each time the cuttlefish showed it could wait, the researchers tacked another ten seconds on to the next round of waiting before releasing the shrimp. The longest that a cuttlefish waited was 130 seconds.

Schnell [says] that the cuttlefish usually sat at the bottom of the tank and looked at the two food items while they waited, but sometimes, they would turn away from the king prawn "as if to distract themselves from the temptation of the immediate reward," In past studies, humans, chimpanzees, parrots and dogs also tried to distract themselves while waiting for a reward.

Not every species can use self-control, but most of the animals that can share another trait in common: long, social lives. Cuttlefish, on the other hand, are solitary creatures that don't form relationships even with mates or young.... "We don't know if living in a social group is important for complex cognition unless we also show those abilities are lacking in less social species," says... comparative psychologist Jennifer Vonk.

Q. 1. All of the following constitute a point of difference between the "original" and "modified" versions of the marshmallow test EXCEPT that:

1. the former was performed over a longer time span than the latter.
2. the former had human subjects, while the latter had cuttlefish.
3. the former used verbal communication with its subjects, while the latter had to develop a symbolic means of communication.
4. the former correlated self-control and future success, while the latter correlated self-control and survival advantages.

Q. 2. Which one of the following, if true, would best complement the passage's findings?

1. Cuttlefish cannot distinguish between geometrical shapes.
2. Cuttlefish are equally fond of live grass shrimp and raw prawn.
3. Cuttlefish wait longer than 100 seconds for the shrimp drawer to open up.
4. Cuttlefish live in big groups that exhibit sociability.

Q. 3. Which one of the following cannot be inferred from Alexandra Schnell's experiment?

1. Cuttlefish exert self-control with the help of diversions.
2. Intelligence in a species is impossible without sociability.
3. Cuttlefish exercise choice when it comes to food.
4. Like human children, cuttlefish are capable of self-control.

Q. 4. In which one of the following scenario would the cuttlefish's behaviour demonstrate self-control?

1. Raw prawns are released while a live grass shrimp drawer labelled with a square is placed in front of the cuttlefish.
2. Asian shore crabs and raw prawns are simultaneously released while a live grass shrimp drawer labelled with a triangle is placed in front of the cuttlefish to be opened after one minute.
3. Raw prawns are released while an Asian shore crab drawer labelled with a triangle is placed in front of the cuttlefish, to be opened after one minute.
4. Live grass shrimp are released while two raw prawn drawers labelled with a circle and a triangle respectively are placed in front of the cuttlefish; the triangle-labelled drawer is opened after 50 seconds.

Passage 2

Directions (Q. 5 to 8): *The passage below is accompanied by a set of questions. Choose the best answer to each question.*

We cannot travel outside our neighbourhood without passports. We must wear the same plain clothes. We must exchange our houses every ten years. We cannot avoid labour. We all go to bed at the same time. We have religious freedom, but we cannot deny that the soul dies with the body, since 'but for the fear of punishment, they would have nothing but contempt for the laws and customs of society'. In More's time, for much of the population, given the plenty and security on offer, such restraints would not have seemed overly unreasonable. For modern readers, however, Utopia appears to rely upon relentless transparency, the repression of variety, and the curtailment of privacy. Utopia provides security: but at what price? In both its external and internal relations, indeed, it seems perilously dystopian.

Such a conclusion might be fortified by examining selectively the tradition which follows More on these points. This often portrays societies where 'it would be almost impossible for man to be depraved, or wicked'. This is achieved both through institutions and more. which underpin the common life. The passions are regulated and inequalities of wealth and distinction are minimized. Needs, vanity, and emulation are restrained, often by prizing equality and holding riches in contempt. The desire for public power is curbed. Marriage and sexual intercourse are often controlled. In Tommaso Campanella's The City of the Sun (1623),

the first great literary utopia after More's, relations are forbidden to men before the age of twenty-one and women before nineteen. Communal child-rearing is normal; for Campanella this commences at age two. Greater simplicity of life, 'living according to nature', is often a result: the desire for simplicity and purity are closely related. People become more alike in appearance, opinion, and outlook than they often have been. Unity, order, and homogeneity thus prevail at the cost of individuality and diversity. This model, as J. C. Davis demonstrates, dominated early modern utopianism. And Utopian homogeneity remains a familiar theme well into the twentieth century.

Given these considerations, it is not unreasonable to take as our starting point here the hypothesis that utopia and dystopia evidently share more in common than is often supposed. Indeed, they might be twins, the progeny of the same parents. Insofar as this proves to be the case, my linkage of both here will be uncomfortably close for some readers. Yet we should not mistake this argument for the assertion that all utopias are or tend to produce, dystopias. Those who defend this proposition will find that their association here is not nearly close enough. For we have only to acknowledge the existence of thousands of successful intentional communities in which a cooperative ethos predominates and where harmony without coercion is the rule to set aside such an assertion. Here the individual's submersion in the group is consensual (though this concept is not unproblematic). It results not in enslavement but voluntary submission to group norms. Harmony is achieved without harming others.

Q. 5. All of the following arguments are made in the passage EXCEPT that:

1. There have been thousands of communities where homogeneity and stability have been achieved through choice, rather than by force.

2. In early modern utopianism, the stability of utopian societies was seen to be achieved only with individuals surrendering their sense of self.

3. In More's time, there was plenty of security, so people did not need restraints that could appear unreasonable.

4. The tradition of utopian literature has often shown societies in which it would be nearly impossible for anyone to be sinful or criminal.

Q. 6. All of the following statements can be inferred from the passage EXCEPT that:

1. many conceptions of utopian societies emphasise the importance of social uniformity and cultural homogeneity.

2. it is possible to see utopias as dystopias, with a change in perspective, because one person's utopia could be seen as another's dystopia.

3. utopian societies exist in a long tradition of literature dealing with imaginary people practicing imaginary customs, in imaginary worlds.

4. utopian and dystopian societies are twins, the progeny of the same parents.

Q. 7. Following from the passage, which one of the following may be seen as a characteristic of a utopian society?

1. A society where public power is earned through merit rather than through privilege.

2. Institutional surveillance of every individual to ensure his/her security and welfare.

3. The regulation of homogeneity through promoting competitive heterogeneity.

4. A society without any laws to restrain one's individuality.

Q. 8. Which sequence of words below best captures the narrative of the passage?

1. Utopia-Security-Homogeneity-Intentional community

2. Relentless transparency–Homogeneity-Utopia-Dystopia

3. Utopia-Security–Dystopia–Coercion.

4. Curtailment of privacy–Dystopia–Utopia–Intentional community

Passage 3

Directions (Q. 9 to 12): *The passage below is accompanied by a set of questions. Choose the best answer to each question.*

The sleights of hand that conflate consumption with virtue are a central theme in A Thirst for Empire, a sweeping and richly detailed history of tea by the historian Erika Rappaport. How did tea evolve from

an obscure 'China drink" to a universal beverage imbued with civilising properties? The answer, in brief, revolves around this conflation, not only by profit-motivated marketers but by a wide variety of interest groups. While abundant historical records have allowed the study of how tea itself moved from east to west, Rappaport is focused on the movement of the idea of tea to suit particular purposes.

Beginning in the 1700s, the temperance movement advocated for tea as a pleasure that cheered but did not inebriate, and industrialists soon borrowed this moral argument in advancing their case for free trade in tea (and hence more open markets for their textiles). Factory owners joined in, compelled by the cause of a sober workforce, when Christian missionaries discovered that tea "would soothe any colonial encounter". During the Second World War, tea service was presented as a social and patriotic activity that uplifted soldiers and calmed refugees.

But it was tea's consumer-directed marketing by importers and retailers - and later by brands - that most closely portends current trade debates. An early version of the "farm to table" movement was sparked by anti-Chinese sentiment and concerns over trade deficits, as well as by the reality and threat of adulterated tea containing dirt and hedge clippings. Lipton was soon advertising "from the Garden to Tea Cup" supply chains originating in British India and supervised by "educated Englishmen". While tea marketing always presented direct consumer benefits (health, energy, relaxation), tea drinkers were also assured that they were participating in a larger noble project that advanced the causes of family, nation and civilization....

Rappaport's treatment of her subject is refreshingly apolitical. Indeed, it is a virtue that readers will be unable to guess her political orientation: both the miracle of markets and capitalism's dark underbelly are evident in tea's complex story, as are the complicated effects of British colonialism. Commodity histories are now themselves commodities: recent works investigate cotton, salt, cod, sugar, chocolate, paper and milk. And morality marketing is now a commodity as well, applied to food, "fair trade" apparel and eco-tourism. Yet tea is, Rappaport makes clear, a world apart – an astonishing success story in which tea marketers not only succeeded in conveying a sense of moral elevation to the consumer but also arguably did advance the cause of civilisation and community.

I have been offered tea at a British garden party, a Bedouin campfire, a Turkish carpet shop and a Japanese chashitsu, to name a few settings. In each case the offering was more an idea – friendship, community, respect – than a drink, and in each case the idea then created a reality. It is not a stretch to say that tea marketers have advanced the particularly noble cause of human dialogue and friendship.

Q. 9. The author of this book review is LEAST likely to support the view that:

1. tea drinking was sometimes promoted as a patriotic duty.
2. tea drinking has become a social ritual worldwide.
3. the ritual of drinking tea promotes congeniality and camaraderie.
4. tea became the leading drink in Britain in the nineteenth century.

Q. 10. This book review argues that, according to Rappaport, tea is unlike other "morality" products because it:

1. appealed to a universal group and not just to a niche section of people.
2. had an actual beneficial effect on social interaction and society in general.
3. was marketed by a wide range of interest groups.
4. was actively encouraged by interest groups in the government.

Q. 11. Today, "conflat[ing] consumption with virtue" can be seen in the marketing of:

1. sustainably farmed foods.
2. travel to pristine destinations.
3. ergonomically designed products.
4. natural health supplements.

Q. 12. According to this book review, A Thirst for Empire says that, in addition to "profit-motivated marketers", tea drinking was promoted in Britain by all of the following EXCEPT:

1. factories to instill sobriety in their labour.
2. the anti-alcohol lobby as a substitute for the consumption of liquor.
3. tea drinkers lobbying for product diversity.
4. manufacturers who were pressing for duty-free imports.

Passage 4

Directions (Q. 13 to 16): *The passage below is accompanied by a set of questions. Choose the best answer to each question.*

For the Maya of the Classic period, who lived in Southern Mexico and Central America between 250 and 900 CE, the category of 'persons' was not coincident with human beings, as it is for us. That is, human beings were persons – but other, nonhuman entities could be persons, too. ... In order to explore the slippage of categories between 'humans' and 'persons', I examined a very specific category of ancient Maya images, found painted in scenes on ceramic vessels. I sought out instances in which faces (some combination of eyes, nose, and mouth) are shown on inanimate objects. . . . Consider my iPhone, which needs to be fed with electricity every night, swaddled in a protective bumper, and enjoys communicating with other fellow-phone-beings. Does it have personhood (if at all) because it is connected to me, drawing this resource from me as an owner or source? For the Maya (who did have plenty of other communicating objects, if not smartphones), the answer was no. Nonhuman persons were not tethered to specific humans, and they did not derive their personhood from a connection with a human. It's a profoundly democratising way of understanding the world. Humans are not more important persons – we are just one of many kinds of persons who inhabit this world.

The Maya saw personhood as 'activated' by experiencing certain bodily needs and through participation in certain social activities. For example, among the faced objects that I examined, persons are marked by personal requirements (such as hunger, tiredness, physical closeness), and by community obligations (communication, interaction, ritual observance). In the images I examined, we see, for instance, faced objects being cradled in humans' arms; we also see them speaking to humans. These core elements of personhood are both turned inward, what the body or self of a person requires, and outward, what a community expects of the persons who are a part of it, underlining the reciprocal nature of community membership.

Personhood was a nonbinary proposition for the Maya. Entities were able to be persons while also being something else. The faced objects I looked at indicate that they continue to be functional, doing what objects do (a stone implement continues to chop, an incense burner continues to do its smoky work). Furthermore, the Maya visually depicted many objects in ways that indicated the material category to which they belonged – drawings of the stone implement show that a person-tool is still made of stone. One additional complexity: the incense burner (which would have been made of clay, and decorated with spiky appliques representing the sacred ceiba tree found in this region) is categorised as a person – but also as a tree. With these Maya examples, we are challenged to discard the person/nonperson binary that constitutes our basic ontological outlook. . . . The porousness of boundaries that we have seen in the Maya world points towards the possibility of living with a certain uncategorisability of the world.

Q. 13. Which one of the following, if true, would not undermine the democratising potential of the Classic Maya worldview?

1. They believed that animals like cats and dogs that live in proximity to humans have a more clearly articulated personhood.

2. They understood the stone implement and the incense burner in a purely human form.

3. They depicted their human healers with physical attributes of local medicinal plants.

4. While they believed in the personhood of objects and plants, they did not believe in the personhood of rivers and animals.

Q. 14. Which one of the following best explains the "additional complexity" that the example of the incense burner illustrates regarding personhood for the Classic Maya?

1. The example provides an exception to the nonbinary understanding of personhood that the passage had hitherto established.

2. The example adds a new layer to the nonbinary understanding of personhood by bringing in a third category that shares a similar relation with the previous two.

3. The example adds a new layer to the nonbinary understanding of personhood by bringing in a third category that shares a dissimilar relation with the previous two.

4. The example complicates the nonbinary understanding of personhood by bringing in the sacred, establishing the porosity of the divine and the profane.

Q. 15. On the basis of the passage, which one of the following worldviews can be inferred to be closest to that of the Classic Maya?

1. A tribe that perceives its utensils as person-utensils in light of their functionality and bodily needs.
2. A tribe that perceives its hunting weapons as sacred person-artefacts because of their significance to its survival.
3. A futuristic society that perceives robots to be persons as well as robots because of their similarity to humans.
4. A tribe that perceives plants as person-plants because they form an ecosystem and are marked by needs of nutrition.

Q. 16. Which one of the following, if true about the Classic Maya, would invalidate the purpose of the iPhone example in the passage?

1. The clay incense burner with spiky appliques was categorised only as a person and not as a tree by the Classic Maya.
2. Classic Maya songs represent both humans and non-living objects as characters, talking and interacting with each other.
3. Unlike modern societies equipped with mobile phones, the Classic Maya did not have any communicating objects.
4. The personhood of the incense burner and the stone chopper was a function of their usefulness to humans.

Q. 17. The four sentences (labelled 1, 2, 3, 4) below, when properly sequenced would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:

1. In the central nervous systems of other animal species, such a comprehensive regeneration of neurons has not yet been proven beyond doubt.
2. Biologists from the University of Bayreuth have discovered a uniquely rapid form of regeneration in injured neurons and their function in the central nervous system of zebrafish.
3. They studied the Mauthner cells, which are solely responsible for the escape behaviour of the fish, and previously regarded as incapable of regeneration.
4. However, their ability to regenerate crucially depends on the location of the injury.

Q. 18. Five jumbled up sentences, related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd one out and key in the number of the sentence as your answer:

1. There is a dark side to academic research, especially in India, and at its centre is the phenomenon of predatory journals.
2. But in truth, as long as you pay, you can get anything published.
3. In look and feel thus, they are exactly like any reputed journal.
4. They claim to be indexed in the most influential databases, say they possess editorial boards that comprise top scientists and researchers, and claim to have a rigorous peer-review structure.
5. But a large section of researchers and scientists across the world are at the receiving end of nothing short of an academic publishing scam.

Q. 19. The four sentences (labelled 1, 2, 3, 4) below, when properly sequenced would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:

1. The work is more than the text, for the text only takes on life, when it is realized and furthermore the realization is by no means independent of the individual disposition of the reader.
2. The convergence of text and reader brings the literary work into existence and this convergence is not to be identified either with the reality of the text or with the individual disposition of the reader.
3. From this polarity it follows that the literary work cannot be completely identical with the text, or with the realization of the text, but in fact must lie half way between the two.
4. The literary work has two poles, which we might call the artistic and the aesthetic;

the artistic refers to the text created by the author, and the aesthetic to the realization accomplished by the reader.

Q. 20. Five jumbled up sentences, related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd one out and key in the number of the sentence as your answer:

1. The legal status of resources mined in space remains ambiguous; and while the market for asteroid minerals is currently nonexistent, this is likely to change as technical hurdles diminish.

2. Outer space is a commons, and all of it is open for exploration, however, space law developed in the 1950s and 60s is state-centric and arguably ill-suited to a commercial future.

3. Laws adopted by the US and Luxembourg are first steps, but they only protect firms from competing claims by their compatriots; a Chinese company will not be bound by the US law.

4. Critics say the US is conferring rights that it has no authority to confer; Russia in particular has condemned this, citing the US' disrespect for international law.

5. At issue now is commercial activity, as private firms-rather than nation states look to space for profit.

Q. 21. The four sentences (labelled 1, 2, 3, 4) below, when properly sequenced would yield a coherent paragraph. Decide on the proper sequencing of the order of the sentences and key in the sequence of the four numbers as your answer:

1. A popular response is the exhortation to plant more trees.

2. It seems all but certain that global warming will go well above two degrees-quite how high no one knows yet.

3. Burning them releases it, which is why the scale of forest fires in the Amazon basin last year garnered headlines.

4. This is because trees sequester carbon by absorbing carbon dioxide.

Q. 22. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Foreign peacekeepers often exist in a bubble in the poor countries in which they are deployed; they live in posh compounds, drive fancy vehicles, and distance themselves from locals. This may be partially justified as they are outsiders, living in constant fear, performing a job that is emotionally draining. But they are often despised by the locals, and many would like them to leave. A better solution would be bottom-up peace building, which would involve their spending more time working with communities, understanding their grievances and earning their trust, rather than only meeting government officials.

1. Peacekeeping forces in foreign countries have tended to be aloof for valid reasons but would be more effective if they worked more closely with local communities.

2. Extravagant lifestyles and an aloof attitude among the foreigners working as peacekeepers in poor countries have justifiably made them the target of local anger.

3. Peacekeeping duties would be more effectively performed by local residents given their better understanding, knowledge and rapport with their own communities.

4. The environment in poor countries has tended to make foreign peacekeeping forces live in enclaves, but it is time to change this scenario.

Q. 23. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

McGurk and MacDonald (1976) reported a powerful multisensory illusion occurring with audio-visual speech. They recorded a voice articulating a consonant 'ba-ba-ba' and dubbed it with a face articulating another consonant 'ga-ga-ga'. Even though the acoustic speech signal was well recognized alone, it was heard as another consonant after dubbing with in congruent visual speech i.e., 'da-da-da'. The illusion, termed as the McGurk effect, has been replicated many times, and it has sparked an abundance

of research. The reason for the great impact is that this is a striking demonstration of multisensory integration, where that auditory and visual information is merged into a unified, integrated percept.

1. The McGurk effect which is a demonstration of multisensory integration has been replicated many limes.
2. Visual speech mismatched with auditory speech can result in the perception of an entirely different message: this illusion is known as the McGurk effect.
3. When the auditory speech signal does not match the visual speech movements, the acoustic speech signal is confusing and integration of the two is imperfect.
4. When the quality of auditory information is poor, the visual information wins over the auditory information.

Q. 24. The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Developing countries are becoming hotbeds of business innovation in much the same way as Japan did from the 1950s onwards. They are reinventing systems of production and distribution, and experimenting with entirely new business models. Why are countries that were until recently associated with cheap hands now becoming leaders in innovation? Driven by a mixture of ambition and fear they are relentlessly climbing up the value chain. Emerging-market champions have not only proved highly competitive in their own backyards, they are also going global themselves.

1. Production and distribution models are going through rapid innovations worldwide as developed countries are being challenged by their earlier suppliers from the developing world.
2. Competition has driven emerging economies, once suppliers of cheap labour, to become innovators of business models that have enabled them to move up the value chain and go global.
3. Innovations in production and distribution are helping emerging economies compete with countries to which they once supplied cheap labour.
4. Developing countries are being forced to invent new business models which challenge the old business models, so they can remain competitive domestically.

Data Interpretation and Logical Reasoning (DILR)

Directions (Q. 1 to 6): *Read the following passage carefully and answer the questions that follows*:

A journal plans to publish 18 research papers, written by eight authors (A, B, C, D, E, F, G, and H) in four issues of the journal scheduled in January, April, July and October. Each of the research papers was written by exactly one of the eight authors. Five papers were scheduled in each of the first two issues, while four were scheduled in each of the last two issues. Every author wrote at least one paper and at most three papers. The total number of papers written by A, D, G and H was double the total number of papers written by the other four authors. Four of the authors were from India and two each were from Japan and China. Each author belonged to exactly one of the three areas — Manufacturing, Automation and Logistics. Four of the authors were from the Logistics area and two were from the Automation area. As per the journal policy, none of the authors could have more than one paper to any issue of the journal.

The following facts are also known.

1. F, an Indian author from the Logistics area, wrote only one paper. It was scheduled in the October issue.
2. A was from the Automation area and did not have a paper scheduled in the October issue.
3. None of the Indian authors were from the Manufacturing area and none of the Japanese or Chinese authors were from the Automation area.
4. A and H were from different countries, but had their papers scheduled in exactly the same issues.
5. C and E, both Chinese authors from different areas, had the same number of papers scheduled. Further, E had papers scheduled in consecutive issues of the Journal but C did not.
6. B, from the Logistics area, had a paper scheduled in the April issue of the Journal.
7. B and G belonged to the same country. None of their papers were scheduled in the same issue of the Journal.
8. D, a Japanese author from the Manufacturing area, did not have a paper scheduled in the July issue.
9. C and H belonged to different areas.

Q. 1. What is the correct sequence of number of papers written by B, C, E and G, respectively?

1. 1, 2, 2, 3 **2.** 3, 1, 1, 3
3. 1, 2, 2, 1 **4.** 1, 3, 3, 1

Q. 2. How many papers were written by Indian authors?

Q. 3. Which of the following statement(s) MUST be true?

Statement A: Every issue had atleast one paper by author(s) from each country.
Statement B: Every issue had at most two papers by author(s) from each area.

1. Neither of the statements
2. Both the statements
3. Only Statement A
4. Only Statement B

Q. 4. Which of the following statements is FALSE?

1. Every issue had atleast one paper by author(s) from Automation area.
2. Every issue had exactly one paper by a Chinese author.
3. Every issue had exactly two papers by authors from Logistics area.
4. Every issue had exactly two papers by Indian authors.

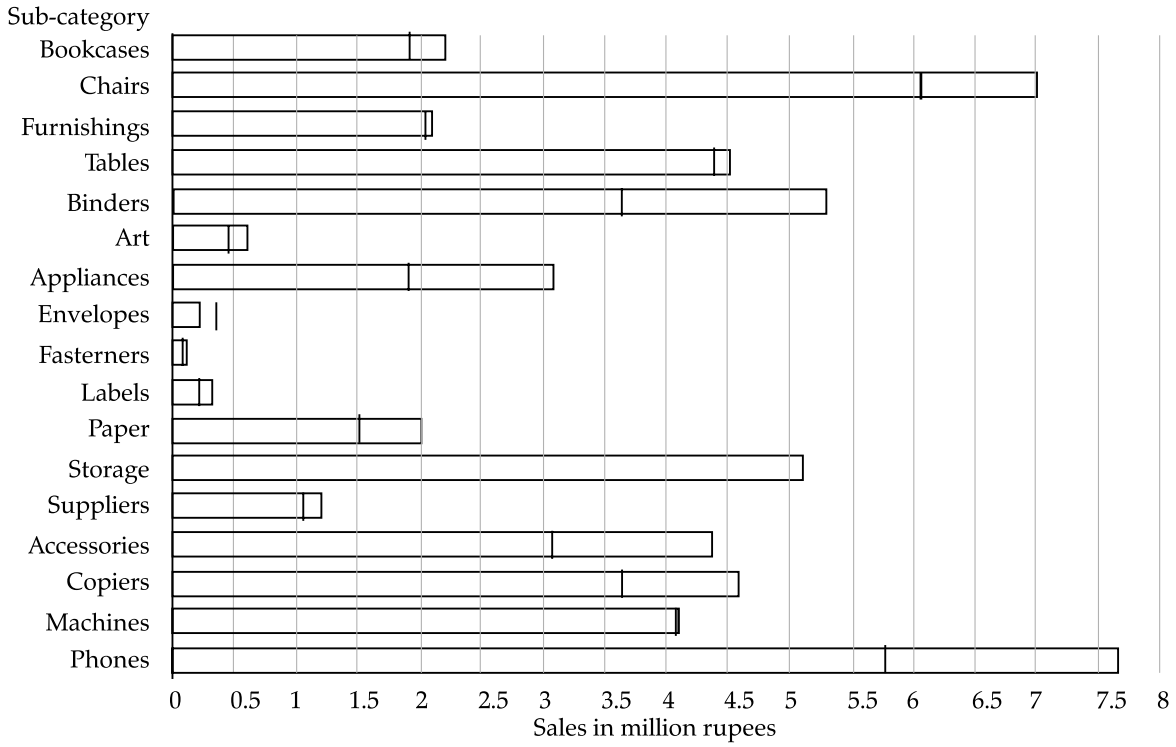
Q. 5. Which of the following statements is FALSE?

1. There were exactly two papers by authors from Manufacturing area in the July issue.
2. There were exactly two papers by authors from Manufacturing area in the January issue.
3. There was exactly one paper by an author fom Logistics area in the October issue.
4. There was exactly one paper by an author from Manufacturing area in the April issue.

Q. 6. Which of the following is the correct sequence of number of papers by authors from Automation, Manufacturing and Logistics areas, respectively?

1. 6, 6, 6 **2.** 6, 5, 7
3. 5, 6, 7 **4.** 6, 7, 5

Directions (Q. 7 to 10): *Read the following passage and bar chart carefully and answer the questions that follows*:



The horizontal bars in the above diagram represent 2020 aggregate sales (in ₹ million) of a company for the different subcategories of its products. The top four product subcategories (Bookcases, Chairs, Furnishings, Tables) belong to furniture product category; the bottom four product subcategories (Accessories, Copiers, Machines, Phones) belong to the technology product category while all other product subcategories belong to the office supply product category. For each of the product subcategories, there is a vertical line indicating the sales of the corresponding subcategory in 2019.

Q. 7. The total sales (in ₹ million) in 2019 from products in office supplies category is closest to

1. 13.5 **2.** 12.5
3. 18.0 **4.** 16.5

Q. 8. The percentage increase in sales in Furniture category from 2019 to 2020 is closest to

1. 1% **2.** 25%
3. 20% **4.** 8%

Q. 9. How many subcategories had sales of ₹4 million or more in 2019 and registered an increase in sales in excess of 25% in 2020?

Q. 10. The improvement index for a category is the maximum percentage increase in sales from 2019 to 2020 among any of its subcategories. The correct order of categories in increasing order of this improvement index is

1. furniture, technology, office supply
2. office supply, furniture, technology
3. technology, furniture, office supply
4. office supply, technology, furniture

Directions (Q. 11 to 14): *Read the following passage and tables carefully and answer the questions that follows*:

Ganga, Kaveri, and Narmada are three women who buy four raw materials (Mango, Apple, Banana and Milk) and sell five finished products (Mango smoothie, Apple smoothie, Banana smoothie, Mixed fruit smoothie and Fruit salad). Table-1 gives information about the raw materials required to produce the five finished products. One unit of a finished product requires one unit of each of the raw materials mentioned in the second column of the table.

Table-1

Finished product	Raw materials required
Mango smoothie	Mango, Milk
Apple smoothie	Apple, Milk
Banana smoothie	Banana, Milk
Mixed fruit smoothie	Mango, Apple, Banana, Milk
Fruit salad	Mango, Apple, Banana

One unit of milk, mango, apple, and banana cost ₹5, ₹3, ₹2, and ₹1 respectively. Each unit of a finished product is sold for a profit equal to two times the number of raw materials used to make that product For example, apple smoothie is made with two raw materials (apple and milk) and will be sold for a profit of I 4 per unit. Leftover raw materials are sold during the last business hour of the day for a loss of ₹1 per unit.

The amount in rupees, received from sales (revenue) for each woman in each of the four business hours of the day is given in Table-2.

Table-2

Business Hour	Ganga	Kaveri	Narmada
Hour 1	23	19	31
Hour 2	21	22	21
Hour 3	29	30	23
Hour 4 (last hour)	30	27	22

The following additional facts are known.

1. No one except possibly Ganga sold any Mango smoothie.
2. Each woman sold either zero or one unit of any single finished product in any hour.
3. Each woman had exactly one unit each of two different raw materials as leftovers.
4. No one had any banana leftover.

Q. 11. What BEST can be concluded about the number of units of fruit salad sold in the first hour?

1. Exactly 1 **2.** Either 0 or 1 or 2
3. Either 1 or 2 **4.** Exactly 2

Q. 12. Which of the following is NECESSARILY true?

1. Ganga did not sell any leftover apples
2. Kaveri sold one unit of leftover mangoes
3. Narmada sold one unit of leftover milk
4. Ganga did not sell any leftover mangoes

Q. 13. What BEST can be concluded about the total number of units of milk the three women had in the beginning?

1. Either 18 or 19 units
2. Either 17 or 18 or 19 units
3. Either 18 or 19 or 20 units
4. Either 19 or 20 units

Q. 14. If it is known that three leftover units of mangoes were sold during the last business hour of the day, how many apple smoothies were sold during the day?

Directions (Q. 15 to 20): *Read the following passage and table carefully and answer the questions that follows*:

Amudha, Bharatan, Chandran, Dhinesh, Ezhil, Fani and Gowtham are seven people in a town. Any pair of them could either be strangers, acquaintances, or friends. All relationships are mutual. For example, if Amudha is a friend of Bharatan, then Bharatan is also a friend of Amudha. Similarly, if Amudha is a stranger to Bharatan, then Bharatan is also a stranger to Amudha.

Partial information about the number of friends, acquaintances, and strangers of each of these people among them is given in the table below.

	No. of Friends	No. of Acquaintances	No. of Strangers
Amudha		1	4
Bharatan			
Chandran		1	
Dhinesh			2
Ezhil			1
Fani	1		
Gowtham		3	2

The following additional facts are also known.

1. Amudha, Bharatan, and Chandran are mutual strangers.
2. Amudha, Dhinesh, and Fani are Ezhil's friends.
3. Chandran and Gowtham are friends.
4. Every friend of Amudha is an acquaintance of Bharatan, and every acquaintance of Bharatan is a friend of Amudha.
5. Every friend of Bharatan is an acquaintance of Amudha, and every acquaintance of Amudha is a friend of Bharatan.

Q. 15. Who are Gowtham's acquintances?

1. Dhinesh, Ezhil and Fani
2. Amudha, Dhinesh and Fani
3. Amudha, Bharatan and Fani
4. Bhratan, Dhinesh and Ezhil

Q. 16. Which of these pairs share the same type of relationship?

1. (Chandran, Ezhil) and (Dhinesh, Gowtham)
2. (Bharatan, Chandran) and (Dhinesh, Ezhill)
3. (Bharatan, Ezhil) and (Fani, Gowtham)
4. (Amudha, Gowtham) and (Ezhil, Fani)

Q. 17. Who is an acquintance of Amudha?

1. Ezhil **2.** Gowtham
3. Dhinesh **4.** Fani

Q. 18. Who is an acquintance of Chandran?

1. Bharatan **2.** Dhinesh
3. Ezhil **4.** Fani

Q. 19. How many friends does Ezhil have?

Q. 20. How many people are either a friend or a friend-of-a-friend of Ezhil?

Quantitative Aptitude (QA)

Q. 1. If the area of a regular hexagon is equal to the area of an equilateral triangle of side 12 cm, then the length, in cm, of each side of the hexagon is

1. $4\sqrt{6}$ **2.** $2\sqrt{6}$
3. $6\sqrt{6}$ **4.** $\sqrt{6}$

Q. 2. $f(x) = \dfrac{x^2 + 2x - 15}{x^2 - 7x - 18}$ is negative if and only if

1. $x < -5$ or $-2 < x < 3$
2. $-5 < x < -2$ or $3 < x < 9$
3. $-2 < x < 3$ or $x > 9$
4. $x < -5$ or $3 < x < 9$

Q. 3. Amal purchases some pens at ₹8 each. To sell these, he hires an employee at a fixed wage. He sells 100 of these pens at ₹12 each. If the remaining pens are sold at ₹11 each, then he makes a net profit of ₹300, while he makes a net loss of ₹300 if the remaining pens are sold at ₹9 each. The wage of the employee, in INR, is

Q. 4. Two trains cross each other in 14 seconds when running in opposite directions along parallel tracks. The faster train is 160 m long and crosses a lamp post in 12 seconds. If the speed of the other train is 6 km/hr less than the faster one, its length, in m, is

1. 184 **2.** 192
3. 190 **4.** 180

Q. 5. If r is a constant such that $|x^2 - 4x - 13| = r$ has exactly three distinct real roots, then the value of r is

1. 15 **2.** 21
3. 18 **4.** 17

Q. 6. A basket of 2 apples, 4 oranges and 6 mangoes costs the same as a basket of 1 apple, 4 oranges and 8 mangoes, or a basket of 8 oranges and 7 mangoes. Then the number of mangoes in a basket of mangoes that has the same cost as the other baskets is

1. 13 **2.** 12
3. 11 **4.** 10

Q. 7. The amount Neeta and Geeta together earn in a day equals what Sita alone earns in 6 days. The amount Sita and Neeta together earn in a day equals what Geeta alone earns in 2 days. The ratio of the daily earnings of the one who earns the most to that of the one who earns the least is

1. 11 : 3 **2.** 3 : 2
3. 7 : 3 **4.** 11 : 7

Q. 8. Identical chocolate pieces are sold in boxes of two sizes, small and large. The large box is sold for twice the price of the small box. If the selling price per gram of chocolate in the large box is 12% less than that in the small box, then the percentage by which the weight of chocolate in the large box exceeds that in the small box is nearest to

1. 135 **2.** 124
3. 127 **4.** 144

Q. 9. The strength of an indigo solution in percentage is equal to the amount of indigo in grams per 100 cc of water. Two 800 cc bottles are filled with indigo solutions of strengths 33% and 17%, respectively. A part of the solution from the first bottle is thrown away and replaced by an equal volume of the solution from the second bottle. If the strength of the indigo solution in the first bottle has now changed to 21% then the volume, in cc, of the solution left in the second bottle is

Q. 10. A circle of diameter 8 inches is inscribed in a triangle ABC where $\angle ABC = 90°$. If BC = 10 inches, then the area of the triangle in square inches is

Q. 11. How many three-digit numbers are greater than 100 and increase by 198 when the three digits are arranged in the reverse order?

Q. 12. The number of groups of three or more distinct numbers that can be chosen from 1, 2, 3, 4, 5, 6, 7 and 8 so that the groups always include 3 and 5, while 7 and 8 are never included together is

Q. 13. Onion is sold for 5 consecutive months at the rate of ₹10, ₹20, ₹25, ₹25, and ₹50 per kg, respectively. A family spends a fixed amount of money on onion for each of the first three months, and then spends half that amount on onion for each of the next two months. The

average expense for onion, in rupees per kg, for the family over these 5 months is closest to

1. 16 **2.** 26
3. 20 **4.** 18

Q. 14. If $x_0 = 1$, $x_1 = 2$, and $x_{n+2} = \frac{1 + x_{n+1}}{x_n}$, $n = 0$, 1, 2, 3, ..., then x_{2021} is equal to

1. 1 **2.** 2
3. 3 **4.** 4

Q. 15. Suppose hospital A admitted 21 less Covid infected patients than hospital B, and all eventually recovered. The sum of recovery days for patients in hospitals A and B were 200 and 152, respectively. If the average recovery days for patients admitted in hospital A was 3 more than the average in hospital B, then the number admitted in hospital A was

Q. 16. Suppose the length of each side of a regular hexagon ABCDEF is 2 cm. If T is the mid point of CD, then the length of AT, in cm is

1. $\sqrt{15}$ **2.** $\sqrt{12}$
3. $\sqrt{14}$ **4.** $\sqrt{13}$

Q. 17. Anu, Vinu and Manu can complete a work alone in 15 days, 12 days and 20 days, respectively. Vinu works everyday. Anu works only on alternate days starting from the first day while Manu works only on alternate days starting from the second day. Then, the number of days needed to complete the work is

1. 8 **2.** 5
3. 7 **4.** 6

Q. 18. If $5 - \log_{10}\sqrt{1+x} + 4\log_{10}\sqrt{1-x} = \log_{10}\frac{1}{\sqrt{1-x^2}}$, then $100x$ equals

Q. 19. Amar, Akbar and Anthony are working on a project. Working together Amar and Akbar can complete the project in 1 year, Akbar and Anthony can complete in 16 months, Anthony and Amar can complete in 2 years. If the person who is neither the fastest nor the slowest work alone, the time in months he will take to complete the project is

Q. 20. The number of integers n that satisfy the inequalities $|n-60| < |n-100| < |n-20|$ is

1. 19 **2.** 18
3. 20 **4.** 21

Q. 21. Anil invests some money at a fixed rate of interest, compounded annually. If the interests accrued during the second and third year are ₹806.25 and ₹866.72, respectively, the interest accrued, in INR, during the fourth year is nearest to

1. 931.72 **2.** 926.84
3. 929.48 **4.** 934.65

Q. 22. The natural numbers are divided into groups as (1), (2, 3, 4), (5, 6, 7, 8, 9), ... and so on. Then, the sum of the numbers in the 15th group is equal to

1. 4941 **2.** 6090
3. 6119 **4.** 7471

Answer Key

Verbal Ability and Reading Comprehension (VARC)

1. (4)	2. (4)	3. (2)	4. (2)	5. (3)	6. (4)	7. (2)	8. (1)	9. (4)	10. (2)
11. (1)	12. (3)	13. (3)	14. (2)	15. (4)	16. (4)	17. 2341	18. (5)	19. 4312	20. (4)
21. 2143	22. (1)	23. (2)	24. (2)						

Data Interpretation and Logical Reasoning (DILR)

1. (1)	2. 8	3. (3)	4. (3)	5. (1)	6. (2)	7. (1)	8. (4)	9. (1)	10. (1)
11. (3)	12. (1)	13. (3)	14. 6	15. (1)	16. (3)	17. (3)	18. (4)	19. 3	20. 4

Quantitative Aptitude (QA)

1. (2)	2. (2)	3. 1000	4. (3)	5. (4)	6. (1)	7. (1)	8. (3)	9. 200	10. 120
11. 70	12. 47	13. (4)	14. (2)	15. 35	16. (4)	17. (3)	18. 99	19. 32	20. (1)
21. (1)	22. (3)								

CAT 2021 SHIFT-1 SOLVED PAPER

Answers and Explanations

Verbal Ability and Reading Comprehension (VARC)

1. Option (4) is correct.

The "marshmallow test" was used to test cuttlefish's' self restraint. The former experiment was used with kids, who were made to wait for as long as fifteen minutes to get the second marshmallow. The fruitfulness of this wait was conveyed by the researchers. Whereas, the modified version of the "marshmallow test" had cuttlefish as subjects instead of humans. It involved a wait of 130 seconds, and as per the writer, he had not trained the cuttlefish to wait in any context. They were simply trained to recognize certain shapes that indicated when a food item will become available. Thus, all options, except (4) confirm the differences between the original and modified versions of the "marshmallow test".

2. Option (4) is correct.

The question pertains to a statement, which may not be inferred from the passage, but if proved to be true, would add weightage to the passage's findings. The last paragraph claims that ' not every species can use self-control, but most of the animals that can share another trait in common: long, social lives.' But cuttlefish, inspite of demonstrating the trait of self-control, are solitary creatures that don't form relationships even with mates or young. This aspect that cuttlefish are so different than the other species is part of what makes the new research exciting. (1) is contradicting the inferences of the passage; (2) weakens the argument in the passage. (3) is a truth because cuttlefish do wait for 130 seconds for the shrimp drawer to open up.

Therefore, the assertion that cuttlefish live in big groups that exhibit sociability, if proved a truth, will complement the passage's findings.

3. Option (2) is correct.

Schnell's experiment proved that the cuttlefish usually sat at the bottom of the tank and looked at the two food items while they waited, but sometimes, they would turn away from the king prawn "as if to distract themselves from the temptation of the immediate reward." This proves that cuttlefish exert self-control with the help of diversions. The fact that cuttlefish exercise choice with food is inferred from the second paragraph, where preliminary experiments showed that cuttlefishes' favourite food is live grass shrimp, while raw prawns are so-so and Asian shore crab is nearly unacceptable. Even the aspect of self-control becomes apparent in cuttlefish, when the cuttlefish didn't jump on the prawns if the live grass shrimp (their favourite food) were labelled with a triangle—many waited for the shrimp drawer to open up. The assertion that intelligence of a species is impossible without sociability is proved incorrect in the last paragraph because cuttlefish, being one of the most unsocial species has proved to exercise self-control.

Therefore, the statement that intelligence in a species is impossible without sociability is incorrect.

4. Option (2) is correct.

(3) is negated because cuttlefish are not fond of Asian shore crabs, hence they will not eagerly await them. (4) fail to test the limit of self-control because cuttlefish will exercise self-control when they realise that something better awaits for them, but if they get their favourite food as a priority, they will not look forward to the triangle or circle drawer. While option (1) can be eliminated on the grounds that the live glass shrimp drawer with a square

icon would denote 'never'; therefore the wait would be meaningless , so would be the test for self-control. But with option (2), if Asian shore crabs and raw prawns are simultaneously released , while their favourite food (live grass shrimp) is kept with a triangle to be opened after a minute, the cuttlefish needs to test their restraint by diverting their attention from the immediate food to the live grass shrimp that they may get after a minute.

5. Option (3) is correct.

The portrayal of societies where . . . 'it would be almost impossible for man to be depraved, or wicked' evinces that the tradition of utopian literature has often shown societies in which it would be nearly impossible for anyone to be sinful or criminal. The argument that there have been thousands of communities where homogeneity and stability have been achieved through choice, rather than by force is evident in the last paragraph, when the writer believes that harmony in a utopia can be attained without harming others, this is possible by means of thousands of successful intentional communities which emphasises on a cooperative ethos and harmony without coercion. It is true that in early modern utopianism, the stability of utopian societies was seen to be achieved only with individuals surrendering their sense of self. This is evinced in the examples of the first and second paragraphs, which justifies how 'unity, order, and homogeneity prevail at the cost of individuality and diversity.' (3) has tweaked the information given in the passage- 'In More's time, for much of the population, given the plenty and security on offer, such restraints would not have seemed overly unreasonable.'

Therefore, the argument : 'in More's time, there was plenty and security, so people did not need restraints that could appear unreasonable' cannot be inferred from the passage.

6. Option (4) is correct.

The argument that it is possible to see utopias as dystopias, with a change in perspective, because one person's utopia could be seen as another's dystopia is appropriate because the set of do's and don'ts as elucidated in the first paragraph, clarify that this concept of utopia may 'seem perilously dystopian' to others. To understand (3), we need to look into the literary tradition, if at all, in the passage. The passage refers to Tommaso Campanella's The City of the Sun (1623), the first great literary utopia after More's, evidently both Campanella and More have pondered on the subject of utopia. It is further ascertained in the usage of 'utopian homogeneity remains a familiar theme well into the twentieth century.' This concludes that utopian societies exist in a long tradition of literature dealing with imaginary people practicing imaginary customs, in imaginary worlds. The assertion that many conceptions of utopian societies emphasise the importance of social uniformity and cultural homogeneity is inferred when the writer states how passions are regulated and inequalities of wealth and distinction are minimized, even marriage and sexual intercourse are often controlled. This leads to people being more alike in 'opinion, and outlook than they often have been.' Whereas (4) is incorrect because utopian and dystopian societies 'might be' twins, the progeny of the same parents, and it is based on a hypothesis.

Therefore, the statement utopian and dystopian societies are twins, the progeny of the same parents cannot be inferred.

7. Option (2) is correct.

The writer states in the first and second paragraph that utopia guarantees security, but at what cost? It is 'achieved both through institutions and mores, which underpin the common life.' In other words, the restraints on the people assured their welfare and security. (1) is incorrect in asserting that a utopian society lacked laws in order to restrain one's individuality. In fact, all laws were modelled in tandem with the security of the people, but compromising their individuality. (4) is incorrect as utopia is nowhere referred as a society where public power is earned through merit rather than through privilege. (3) cannot be corroborated from the passage.

Therefore, institutional surveillance of every individual to ensure his/her security and welfare is a characteristic of a utopian society.

8. Option (1) is correct.

The first paragraph centres around Utopia in ancient times and juxtaposes it against the modern version. Next, it goes on to question the objective of utopia that of generating security and welfare. This conclusion is strengthened by looking at the way the society operated-regulation of passions and minimization of inequalities of wealth and distinction; curbing of desire for public power and so on. These call for 'homogeneity that prevails at the cost of individuality and diversity.' Next, the writer argues that utopia needs to be conveyed not through the submersion of individuality, but the predominance of cooperative ethos, which is the essence of the existence of thousands of successful intentional communities.

Therefore, the narrative of the passage follows the pattern: Utopia – Security – Homogeneity – Intentional community.

9. Option (4) is correct.

The writer will definitely vouch for tea drinking being sometimes promoted as a patriotic duty when he says, 'During the Second World War, tea service was presented as a social and patriotic activity that uplifted soldiers and calmed refugees.' The claim that the ritual of drinking tea promotes congeniality and camaraderie is elaborated when the writer, in the concluding paragraph, gives examples of different settings where he was offered tea, and in each case the 'offering was more an idea – friendship, community, respect – than a drink, and in each case the idea then created a reality.' It is implied through Rappaport's treatment of the subject (evolution of tea and its varied purposes) that tea was promoted as a cheer drink and it lives on till date to promote the noble cause of human dialogue and friendship. While (4) is not inferred from the passage.

Therefore, the author of this book review will not agree that tea became the leading drink in Britain in the nineteenth century.

10. Option (2) is correct.

Rappaport makes it evident through his arguments on tea's evolution and benefits that it is 'a world apart'. It injects a sense of moral elevation to the consumer 'but also arguably did advance the cause of civilisation and community.' Thus, it evinces that according to Rappaport, tea had an actual beneficial effect on social interaction and society in general. The argument on tea appealing to a universal group instead of an elective section of people cannot be justified. The argument on tea, being actively encouraged by interest groups in the government is absurd. The assertion that tea was marketed by a wide range of interest groups unlike other "morality" products is unfounded.

Therefore, according to Rappaport, tea is unlike other "morality" products because it had an actual beneficial effect on social interaction and society in general.

11. Option (1) is correct.

The idea of "conflat[ing] consumption with virtue" must be interpreted from the connotation of the phrase – mixing consumption and virtue, as happened with tea, when tea marketing always presented direct consumer benefits along with the advancement of the causes of family, nation and civilization. This can be best represented in the marketing of sustainably farmed foods. (2) and (3) cannot be justified because they do not include the consumption part, while (4) supplements cannot be argued as coalescing consumption with virtue, as much as sustainably farmed foods.

Therefore, today "conflat[ing] consumption with virtue" can be seen in the marketing of sustainably farmed foods.

12. Option (3) is correct.

The fact that 'industrialists soon borrowed this moral argument in advancing their case for free trade in tea' affirms that tea drinking was promoted in Britain by manufacturers who were pressing for duty-free imports. The 'temperance movement advocated for tea as a pleasure that cheered but did not inebriate' thus was encouraged by factory owners 'compelled by the cause of a sober workforce'. Therefore, both options (2) and (1) are correctly inferred. Whereas, it is nowhere mentioned that tea drinking was promoted in Britain by tea drinkers lobbying for product diversity.

Therefore, the argument that tea drinking was promoted in Britain by tea drinkers lobbying for product diversity is incorrect.

13. Option (3) is correct.

The democratising potential of the Classic Maya worldview holds that humans are not more important persons – we are just one of many kinds of persons who inhabit this world. Moreover, 'nonhuman persons were not tethered to specific humans, and they did not derive their personhood from a connection with a human.' If it is believed that animals like cats and dogs that live in proximity to humans have a more clearly articulated personhood, it makes the Classic Maya worldview questionable. Similarly, (2) also endows nonhumans in a human form. (4) is like giving more importance to the personhood of objects and plants than the personhood of rivers and animals, which is against the essence of the Classic Maya worldview- not any form is more important than the other. (3) does not question the efficacy of the Classic Maya worldview.

Therefore, all of the options, except (3) would not undermine the democratising potential of the Classic Maya worldview.

14. Option (2) is correct.

The additional complexity that the incense burner illustrates needs to be understood from the perspective of Maya, which depicts many objects in ways that indicated the material category to which they belonged and also the functions they served. To this is added a further layer – the incense burner, can not only be categorised as a person – but also as a tree. All these, instead of challenging the Classic Maya view, it enables us to 'discard the person/nonperson binary that constitutes our basic ontological outlook.' Thus, the additional complexity that the incense burner illustrates does not offer a dissimilar or complex nonbinary understanding of personhood.

Therefore, the example of the incense burner adds a new layer to the nonbinary understanding of personhood by bringing in a third category that shares a similar relation with the previous two.

15. Option (4) is correct.

As per the writer, 'personhood was a nonbinary proposition for the Maya. Entities were able to be persons while also being something else.' This is best reflected in (4) – a tribe that perceives plants as person-plants because they form an ecosystem and are marked by needs of nutrition. Here, the plants derive personhood not because of humans but by its needs of nutrition. (1) and (2) are eliminated because it is the functionality to humans that is giving them personhood. This was not the case with Maya people. (3) focuses on the similarity of robots to humans, which is incorrect.

16. Option (4) is correct.

The iPhone example in the passage is used in the passage to determine if inanimate objects, like iPhone, enjoy personhood, as an iPhone enjoys human intervention and is attached to specific humans . According to the Maya, 'Nonhuman persons were not tethered to specific humans, and they did not derive their personhood from a connection with a human. . . .' This would be invalidated if it is claimed that the personhood of the incense burner and the stone chopper was a function of their usefulness to humans, thus negating the argument of the Classic Maya, that personhood connotes detachment of non-humans with humans. (2) does not contribute in negating the view of personhood; (1) is absurd; (3) is irrelevant and does not deal with personhood of nonhumans.

Therefore, the personhood of the incense burner and the stone chopper was a function of their usefulness to humans, if true, would invalidate the purpose of the iPhone example in the passage.

17. Correct answer is [2341].

The paragraph illustrates the extraordinary regeneration of neurons in zebrafish. (2) should be the introductory statement, introducing the subject. It commences with how biologists discovered a uniquely rapid form of regeneration in injured neurons and their function in the central nervous system of zebrafish. The pronoun 'they' in (3), refers to these biologists, and goes on to elaborate on their study, offering a glimpse of how Mauthner cells in the zebrafish are incapable of regeneration. The conjunction 'however' justifies the 3-4 link. In other words, despite Mauthner cells, being previously regarded as incapable of regeneration, their ability to

regenerate crucially depends on the location of the injury. (1) sums up the preceding sentences, that is, apart from zebrafish, in the central nervous systems of other animal species, such a comprehensive regeneration of neurons has not yet been proven beyond doubt.

18. Option (5) is correct.

The correct sequence of the jumbled up sentences is 1432. (1) initiates the topic – the dark aspect of predatory journals. These journals are portrayed to be indexed in the most influential databases and claim to have a rigorous peer-review structure. In a nutshell, predatory journals are exactly like any reputed journal, in both look and feel. But the actuality is different – as long as you pay, you can get anything published. Therefore, the link 4-3-2 is confirmed. While, (5) entails a varied subject- 'academic publishing scam' which makes it the odd-one out.

19. Correct answer is [4312].

The correct sequence is 4312. (4) introduces the two poles of literary work – the artistic and the aesthetic. It is from this polarity, that it can be established that the literary work cannot be completely identical with the text, or with the realization of the text, but in fact must lie halfway between the two. This approach is elaborated in (1) – since the text only takes on life, when it is realized and furthermore the realization is by no means independent of the individual disposition of the reader. (1) establishes that realization of the text is not independent of the individual disposition of the reader. It is this convergence of text and reader, that brings the literary work into existence. Therefore, 3-1-2 is an important link.

20. Option (4) is correct.

(1) introduces the idea of 'legal status of resource mined in space...' and the likability of technical hurdles to diminish; this continues in (5) – this change is in the domain of 'commercial activity'. This strain of 'commercial future' continues in (2). (3) is an extension of the space law. While (4) is about international law, which is unrelated.

21. Correct answer is [2143].

(2) establishes that global warming will go well above two degrees. As a result the common appeal would be to plant more trees. The reason being that trees sequester carbon by absorbing carbon dioxide. The importance of absorbing carbon dioxide is stated in (3) – burning of trees releases more of carbon dioxide, thereby resulting in huge scale of forest fires.

22. Option (1) is correct.

The paragraph reflects two facets of foreign peacekeepers – they distancing themselves from locals because they are involved in a job that is emotionally draining; on the other hand, a better approach would be to spend more time working with communities and understanding their grievances. This is the core of the passage, which gets best reflected in (1). (3) is a tweaked information – declaring that peacekeeping duties would be more effectively performed by local residents. (2) only highlights one side of the issue, instead of balancing it with the solution. (4) is like an opinion derived from the paragraph which fails to capture its essence.

23. Option (2) is correct.

The reader needs to understand that the paragraph is about multisensory illusion occurring with audio-visual speech, referred as the McGurk effect. This topic sentence ought to be the focus of the summary. In this case, (4) is inadequate and the information of the passage is distorted. (1) does mention the McGurk effect, but highlights an irrelevant detail – 'a demonstration of multisensory integration has been replicated many times.' (3) starts off well, but ends with an incorrect assumption ('the acoustic speech signal is confusing and integration of the two is imperfect') ; the correct one being – auditory and visual mismatch can lead to an inappropriate message. Moreover, it misses the reference to McGurk effect. On the other hand, (2) perfectly collates the major idea – the illusion known as the McGurk effect, which involves the mismatch of visual speech with auditory speech that can result in the perception of an entirely different message.

24. Option (2) is correct.

The paragraph highlights how developing countries, once suppliers of cheap labour, have emerged as leaders in innovation, by relentlessly

climbing up the value chain and making an impact domestically as well as globally. This crux of the matter is best represented in (2). (3) adds an inaccurate data – emerging economies are now competing with countries to which they once supplied cheap labour, which is not implied in the paragraph. (4) is ridiculous as it concludes that developing countries are being forced to invent new business models which challenge the old business models, this is a far-fetched information. (1) gives an inaccurate information on how developed countries are being challenged by their earlier suppliers from the developing world. This eliminates all the options, except (2).

Data Interpretation and Logical Reasoning (DILR)

Solution for Questions 1 to 6:

Putting the direct information in the below table.

Total number of research papers = 18,

Paper published by A, D, G, H = 18 × 2/3 = 12 (As the paper published by ADGH is double than the others).

An individual can publish at most 3 papers and at least 1 paper. Paper published by A, D, G, H will be 3 each.

Number of papers published by B, C, E, F altogether = 18 – 12 = 6

Number of authors from India, Japan, and China is 4, 2, and 2 respectively. Number of authors from Logistics, Automation and Manufacturing is 4, 2 and 2 respectively. One author can publish only one paper on one issue and digit in bracket followed by author represents the number of paper published by that author.

Digit in bracket followed by month represents the number of authors published their papers in that particular month.

Country	Areas	Author	January (5)	April (5)	July (4)	October (4)
	Automation	A (3)				✗
	Logistics	B				
China		C		✓		
Japan	Manufacturing	D (3)			✗	
China		E				
India	Logistics	F (1)	✗	✗	✗	✓
		G (3)				
		H (3)				

A has not published in October issue and published 3 papers which means A published in January, April and July issue.

A and H has published papers on exactly same issues, it means that H published in January, April and July issue.

D has not published in July issue and published 3 papers which mean D published in January, April and October issue.

B and G are from same country and in the table, 2 Chinese and 1 Japanese has already occupied position. The only option available for B and G is Indian.

C and E are Chinese authors and work in different areas and they cant work in Automation, it means that one of them worked in logistics and the other one in Manufacturing.

C and E have published same number of papers, E published in consecutive issues but C did not. It means they published 2 papers each and the only possible case for publishing these papers is that E published in April and July. C published in January and October. It can also be concluded that B published only one paper.

Papers of B and G are not on same issue and G has published 3 papers. It means that the papers published by G were in January, July and October issue.

A is from Automation area and Automation can't be the area of Japanese and Chinese. It concludes that A must be an Indian and the only choice left for H is Japanese.

H is Japanese and Automation can't be there with Japanese. A is left with only one choice that is Logistics.

C and H belongs to different areas, it means that C must be from Manufacturing and E from logistics. G has only one option that is Automation.

Country	Areas	Author	January (5)	April (5)	July (4)	October (4)
India	Automation	A (3)	✓	✓	✓	✗
India	Logistics	B (1)	✗	✓	✗	✗
China	Manufacturing	C (2)	✓	✗	✗	✓
Japan	Manufacturing	D (3)	✓	✓	✗	✓
China	Logistics	E (2)	✗	✓	✓	✗
India	Logistics	F (1)	✗	✗	✗	✓
India	Automation	G (3)	✓	✗	✓	✓
Japan	Logistics	H (3)	✓	✓	✓	✗

1. Option (1) is correct.

As per data given in the above table:

Number of papers written by B, C, E and G are 1, 2, 2 and 3 respectively.

2. Correct answer is [8].

As per data given in the above table:

Author who are Indian= A, B, F, G

Number of papers written by A, B, F, G = 3 + 1 + 1 + 3 = 8.

3. Option (3) is correct.

As per data given in the above table:

Statement A is correct.

Statement B is incorrect. (As April issue has 3 papers by authors from logistics which is negating the given condition.)

4. Option (3) is correct.

As per data given in the above table:

1. Every issue had at least one paper by Author(s) from Automation Area. (Correct)
2. Every issue had exactly one paper by Chinese author. (Correct)
3. Every issue had exactly two papers by authors from Logistics Area. (Incorrect)
4. Every issue had exactly two papers by Indian authors. (Correct)

5. Option (1) is correct.

As per data given in the above table:

1. There were exactly two papers by authors from manufacturing area in the July issue. (Incorrect)
2. There were exactly two papers by authors from manufacturing area in the January issue. (Correct)
3. There was exactly one paper by an author from logistics area in the October issue. (Correct)
4. There was exactly one paper by an author from manufacturing area in April issue. (Correct)

6. Option (2) is correct.

As per data given in the above table:

Number of paper by authors from Automation, Manufacturing and Logistics areas are 6, 5 and 7 respectively.

Solution for Questions 7 to 10:

7. Option (1) is correct.

As per data given in bar graph:

Total Sales of product in office supplies in 2019= 3.6 + 0.4 + 1.9 + 0.3 + 0.1 + 0.2 + 1.5 + 4.3 + 1.1 = 13.4. So, the most approximate value is 13.5.

8. Option (4) is correct.

As per data given in bar graph:

Sales of furniture in 2019 = 1.9 + 6.2 + 2 + 4.4 = 14.5

Sales of furniture in 2020 = 2.2 + 7 + 2.1 + 4.5 = 15.8

Increase in the sale of furniture from 2019 to 2020 in terms of percentage = 100 × (1.3/14.5) = 8.9.

So, the most approximate value= 8%

9. Correct answer is [1].

As per data given in bar graph,

Subcategories more than 4 Million = Chairs, Tables, Storage, Machines, Phones

From 2019 to 2020 growth in these subcategories,

Chairs = 0.9/6.1 = 14.75%

Tables = 0.1/4.4 = 2.27%

Storage = 0.8/4.3 = 18.6%

Machines = (–0.9)/4.1 = –21.95%

Phones= 1.9/5.8 = 32.75%

Out of all the above subcategories, only phones having more than million sales in 2019 and have a decadal growth of more than 25%. So, there is only one category which satisfies the condition given in the question.

10. Option (1) is correct.

As per data given in bar graph,

Sales of furniture in 2019 = 1.9 + 6.2 + 2 + 4.4 = 14.5

Sales of furniture in 2020 = 2.2 + 7 + 2.1 + 4.5 = 15.8

Improvement index of furniture = 1.08

Sales of office supply in 2019 = 0.4 + 1.9 + 0.3 + 0.1 + 0.2 +1.5 + 4.3 + 1 = 9.7

Sales of office supply in 2020 = 5.3 + 0.6 + 3.1 + 0.2 + 0.1 + 0.3 + 2 + 5.1 + 1.2 = 17.9

Improvement index of office supply = 1.84

Sales of technology in 2019 = 3.1 + 3.6 + 4.1 + 5.8 = 16.6

Sales of technology in 2020 = 4.4 + 4.6 + 3.2 + 7.7 = 19.9

Improvement index of technology = 1.19

Index in increasing order = Furniture, Technology, Office Supply.

Solution for Questions 11 to 14:

Filling the table as per direct clues:

Raw Material	Cost per Unit	Selling Price of Left over Material @ Loss of ₹1
Mango	₹3	₹2
Apple	₹2	₹1
Banana	₹1	₹0
Milk	₹5	₹4

Finished Product	Required Raw Material	Cost Price of Finished Product	Profit on Selling Finished Product = Number of Raw Material used for Finished Product × 2	Selling Price of Finished Product
Mango smoothie	Mango, Milk	8	4	12
Apple smoothie	Apple, Milk	7	4	11
Banana smoothie	Banana, Milk	6	4	10
Mixed fruit smoothie	Mango, Apple, Banana, Milk	11	8	19
Fruit salad	Mango, Apple, Banana	6	6	12

In 1st hour :

Ganga sold finished product of ₹23, out of the numbers given in the above table, it can be possible only with 12 and 11. Ganga must have sold Apple smoothie and either Mango smoothie or Fruit salad.

Kaveri sold of product of ₹19; it means she has sold only Mixed fruit smoothie.

Narmada sold ₹31 products; it is possible only with 19 and 12. Narmada must have sold 1 each quantity of Fruit salad and Mixed fruit smoothie because she can't sell Mango smoothie.

In 2nd hour :

Ganga sold product of ₹21, it can be done with only ₹10 and 11 which means she has sold 1 quantity each of Apple smoothie and Banana smoothie.

Kaveri sold product of ₹22 which she must have done it with ₹10 and 12 and she can't sell Mango smoothie. She must have done it with Banana smoothie and Fruit salad.

Narmada has sold of ₹21, she must have sold Apple smoothie and Banana smoothie.

In 3rd Hour:

Ganga has sold product of ₹29, she must have sold Banana smoothie and Mixed fruit smoothie.

Kaveri has sold finished product worth ₹30, It means she has sold Apple smoothie and Mixed fruit smoothie.

Narmada has sold product of ₹23. It is possible with Apple smoothie and Fruit salad.

Business Hour	Ganga		Kaveri		Narmada	
Hour 1	23	12(MS or FS)+ 11 (AS)	19	0 + 19 (MFS)	31	12 (FS) +19 (MFS)
Hour 2	21	11 (AS) +10 (BS)	22	10 (BS) + 12 (FS)	21	10 (BS) +11 (AS)
Hour 3	29	10 (BS)+ 19 (MFS)	30	19 (MFS) + 11 (AS)	23	11 (AS) +12 (FS)
Hour 4 (Left Over)	30		27		22	

In Last (4th) hour, each woman has two different materials as left overs & the left over can't be of Banana, the possible pair of material as left over are as follows:

Material	Mango + Apple	Mango+ Milk	Apple + Milk
Leftover Selling Price	2 + 1 = 3	4 + 2 = 6	1 + 4 = 5

The below table shows all the possible cases for 3 woman:

Woman	Possible Cases	Possible Pair of Left Overs	Selling Price of Finished Product		Finished Products + (Left Over Products)
Ganga (30)	Case 1	3	27	×	
	Case 2	6	24	✓	MS + FS + (Mango + Milk)
	Case 3	5	25	×	
Kaveri (27)	Case 1	3	24	×	
	Case 2	6	21	✓	AS + BS + (Mango + Milk)
	Case 3	5	22	✓	FS + BS +(Apple + Milk)
Narmada (22)	Case 1	3	19	✓	MFS + (Mango + Apple)
	Case 2	6	16	×	
	Case 3	5	17	×	

11. Option (3) is correct.

As per data given in the above table:

Number of units of fruit salad sold in 1st hour,

Case 1: 1 Sold by Narmada + 0 by Ganga = 1

Case 2: 1 Sold by Narmada + 1 Sold by Ganga = 2

12. Option (1) is correct.

As per data given in the above table:

Left overs sold by Ganga= Mango and Milk

13. Option (3) is correct.

As per data given in the above table:

Except fruit Salad, milk has been used everywhere. In 18 products, it has definitely used and in 2 products are there is possibility. So, the answer would be either 18 or 19 or 20.

14. Correct answer is [6].

As per data given in the above table:

To sell 3 leftover units of Mango in last hour, Kaveri must have gone with case 2. Considering case 2 for Kaveri as true the total number of Apple smoothie (AS) sold in the whole day = 6

Solution for Questions 15 to 20:

Filling the table as per direct clues:

Friends	Acquain-tances	Strangers		Amudha	Bharatan	Chandran	Dhinesh	Ezhil	Fani	Gowtham
	1	4	Amudha		S	S		F		
			Bharatan	S		S				
	1		Chandran	S	S					F
		2	Dhinesh					F		
		1	Ezhil	F			F		F	
1			Fani					F		
	3	2	Gowtham			F				

Sum of number of friends, acquaintances and strangers for a individual should be 6. So, Amudha must have 1 friend.

Every friend of Amudha is an acquaintance of Bharatan, it means Bharatan has 1 acquaintance.

Every acquaintance of Bharatan is friend of Amudha, which means Bharatan will have 1 acquaintance.

Every friend of Bharatan is acquaintance of Amudha, which means Bharatan will have 1 friend. So out of 6 Bhartan will have 4 strangers.

Gowtham has only one friend Chandran and Bharatan has only one acquaintance Ezhil, It means relation between Gowtham and Bhartan can only be of strangers.

Fani's only friend is Ezhil and Bharatan's only acquaintance is Ezhil, It means the relation between Fani and Bhartan must only be strangers. It concludes that Dhinesh is the only friend of Bhartan. Dhinesh will be acquaintance of Amudha.

For Amudha, Fani and Gowtham will be strangers. Gowtham has three blank places and he has 3 acquaintances, So Dhinesh, Ezhil and Fani will be Gowtham's acquaintances.

Dhinesh has 2 strangers, both are yet to fill and only two places are left. It means Chandran and Fani are strangers to Dhinesh.

Ezhil has one stranger and only possible case is that Chandran is stranger for Ezhil.

Chandran has acquaintance which can only be Fani.

Number table can be filled by counting the strangers acquaintances and friends:

Friends	Acquain-tances	Strangers		Amudha	Bharatan	Chandran	Dhinesh	Ezhil	Fani	Gowtham
1	1	4	Amudha		S	S	A	F	S	S
1	1	4	Bharatan	S		S	F	A	S	S
1	1	4	Chandran	S	S		S	S	A	F
2	2	2	Dhinesh	A	F	S		F	S	A
3	2	1	Ezhil	F	A	S	F		F	A
1	2	3	Fani	S	S	A	S	F		A
1	3	2	Gowtham	S	S	F	A	A	A	

15. Option (1) is correct.

Acquaintances of Gowtham = Dhinesh, Ezhil and Fani.

16. Option (3) is correct.

As per data given in the above table:

1. Chandran & Ezhil are strangers, Dhinesh & Gowtham are acquaintances.
2. Bhartan & Chandran are strangers, Dhinesh & Ezhil are friends.
3. Bhartan & Ezhil are acquaintances, Fani & Gowtham are acquaintances.
4. Amudha & Gowtham are strangers, Ezhil & Fani are friends.

Only Option (3) is satisfying the given condition.

17. Option (3) is correct.

As per data given in the above table:
Acquaintance of Amudha = Dhinesh

18. Option (4) is correct.

As per data given in the above table:
Acquaintance of Chandran = Fani

19. Correct answer is [3].

As per data given in the above table:
Number of friends Ezhil have = 3

20. Correct answer is [4].

As per data given in the above table:
Number of people either friend or a friend of a friend of Ezhil = Number of Ezhils friends + Number of the friend of Ezhil's friend
= 3 + 4 – 3 = 4

Quantitative Aptitude (QA)

1. Option (2) is correct.

Given: Area of a regular hexagon = Area of an equilateral triangle

Side of the equilateral triangle = 12 cm

Let the length of each side of the hexagon be x cm.

Area of the equilateral traingle

$$= \frac{\sqrt{3}}{4} \times (\text{side})^2$$

$$= \frac{\sqrt{3}}{4} \times (12)^2$$

$$= 36\sqrt{3} \text{ sq. cm.}$$

Area of the regular hexagon

$$= \frac{3\sqrt{3}}{2} \times (\text{side})^2$$

$$\therefore \quad 36\sqrt{3} = \frac{3\sqrt{3}}{2} \times x^2$$

$$\Rightarrow \quad 24 = x^2$$

$$\Rightarrow \quad x^2 = 24$$

$$\Rightarrow \quad x = 2\sqrt{6}$$

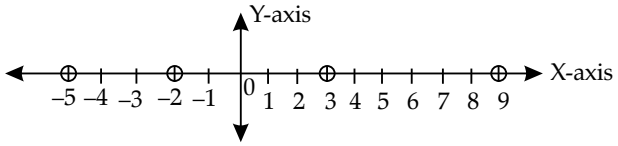
Hence, the length of each side of the hexagon is $2\sqrt{6}$ cm.

2. Option (2) is correct.

$$f(x) = \frac{x^2 + 2x - 15}{x^2 - 7x - 18}$$

$$= \frac{(x+5)(x-3)}{(x-9)(x+2)}$$

$f(x)$ becomes zero at $x = -5$, $x = 3$. Also, $f(x)$ is not defined at $x = -2$ and $x = 9$)



For $x < -5$, say at $x = -6$, $f(x)$ is positive.

For the range of $-5 < x < -2$, say at $x = -4$, $f(x)$ is negative.

For the range of $-2 < x < 3$, say at $x = 0$, $f(x)$ is positive.

For the range of $3 < x < 9$, say at $x = 5$, $f(x)$ is negative.

Also, for $x > 9$, say at $x = 10$, $f(x)$ is positive.

Hence, $f(x)$ is negative if and only if $-5 < x < -2$ or $3 < x < 9$

3. Correct answer is [1000].

Let the total number of pens be x.

$\therefore$ Cost price (C.P.) of x pens at ₹8 each = ₹$8x$

Let the employee's fixed wage be ₹y.

Let's call the combined C.P. of x pens and the employee's fixed wage the "Total C.P."

$\therefore$ Total C.P. = ₹$(8x + y)$

Selling Price (S.P.) of 100 pens at ₹12 each $= 100 \times 12$

= ₹1200

Net profit of ₹300 is made if the remaining pens are sold at the rate of ₹11 each.

Now, the remaining pens = $(x - 100)$

$\therefore$ S.P. of the remaining pens at ₹11 each $= (x - 100) \times 11$ = ₹$(11x - 1100)$

$$\text{Profit} = \text{Total S.P.} - \text{Total C.P.}$$

$$\therefore \quad 300 = \{1200 + (11x - 1100)\} - (8x + y)$$

$$\Rightarrow \quad 300 = 100 + 3x - y$$

$$\Rightarrow \quad 200 = 3x - y \qquad \text{...(i)}$$

Net loss of ₹300 is made if the remaining pens are sold at the rate of ₹9 each.

Remaining pens = $(x - 100)$

$\therefore$ S.P. of remaining pens at ₹9 each

$$= (x - 100) \times 9 = ₹(9x - 900)$$

$$\text{Loss} = \text{Total C.P.} - \text{Total S.P.}$$

$$\therefore \quad 300 = (8x + y) - \{1200 + (9x - 900)\}$$

$$\Rightarrow \quad 300 = -300 - x + y$$

$$\Rightarrow \quad 600 = -x + y \qquad \text{...(ii)}$$

Adding (i) and (ii), we get,

$$800 = 2x$$

$$\Rightarrow \quad \frac{800}{2} = x$$

$$\Rightarrow \quad x = 400$$

Substituting $x = 400$ in (ii), we get,

$$600 = -400 + y$$

$$\Rightarrow \quad y = 600 + 400$$

$$\Rightarrow \quad y = 1000$$

Hence, the wage of the employee is ₹1000.

4. Option (3) is correct.

Given: The faster train is 160 m long and crosses a lamppost in 12 seconds.

Let the speed of the faster train be v_1 m/s.

Speed of faster train (v_1)

$$= \frac{\text{length of the train}}{\text{time taken to cross a lamppost}}$$

$$= \frac{160\text{ m}}{12\text{ s}}$$

$$\Rightarrow \quad v_1 = \frac{40}{3}\text{m/s}$$

Let the speed of the slower train be v_2 m/s.

$$\therefore\ v_2 = \left(\frac{40}{3} - 6\times\frac{5}{18}\right)\text{m/s} \Rightarrow v_2 = \frac{35}{3}\text{m/s}$$

Two trains crosses each other in 14 seconds when running in opposite directions.

Concept: When two trains move opposite to each other, the relative speed will be equal to the summation of the speeds of two trains.
Let the length of the faster train and slower train be l_1 and l_2, respectively.

$$\text{Speed} = \frac{\text{Distance}}{\text{time}}$$

$$\therefore \quad v_1 + v_2 = \frac{l_1 + l_2}{t}$$

$$\Rightarrow \quad \frac{40}{3} + \frac{35}{3} = \frac{160 + l_2}{14}$$

$$\Rightarrow \quad l_2 = 190$$

Hence, the length of the slower train is 190 m.

5. Option (4) is correct.

Given: $|x^2 - 4x - 13| = r$

$\Rightarrow |x^2 - 4x - 13| - r = 0$

$\Rightarrow |(x^2 - 4x + 4) - 13 - 4| - r = 0$

$\Rightarrow |(x-2)^2 - 17| - r = 0$

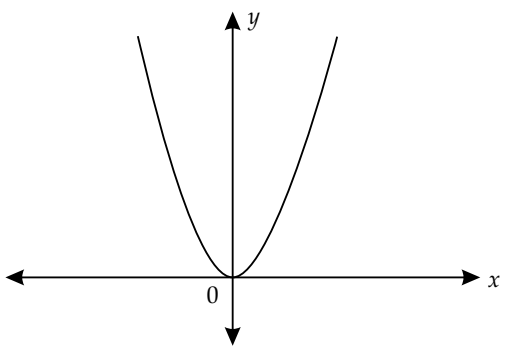
It is given that the above quadratic equation has exactly three distinct real roots.

It means that the given function $|(x-2)^2 - 17| - r$ becomes zero at three values of x.

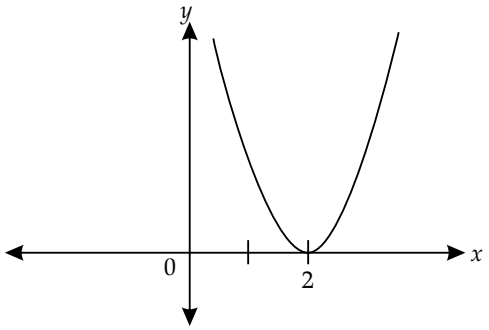
The value of 'r' can be found out using graphical method.

We know that the graph of a quadratic equation is a parabola.

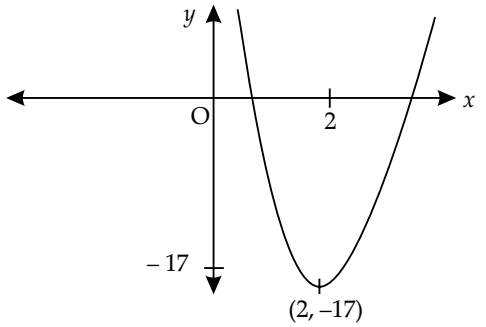
The graph of the function x^2 is as under:



Shifting the above graph by two units to the right of y-axis, gives us the graph of the function $(x-2)^2$ as under:



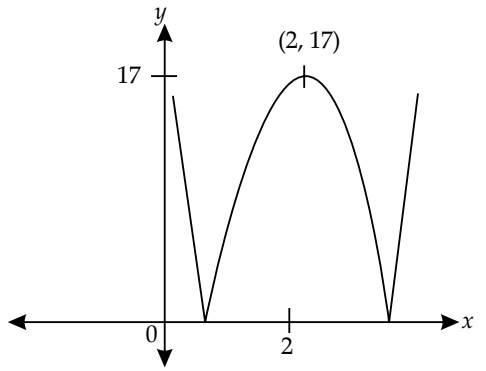
Now, if we shift the above graph by 17 units down to the x-axis, we get the graph of the function $(x-2)^2 - 17$ as under:



We need to find the graph of $|(x-2)^2 - 17|$.

Since the modulus of any function cannot be negative, the graph of $|(x-2)^2 - 17|$ can be given by shifting the 'below x-axis' part of the above graph, above the x-axis.

Thus, the graph becomes as under:



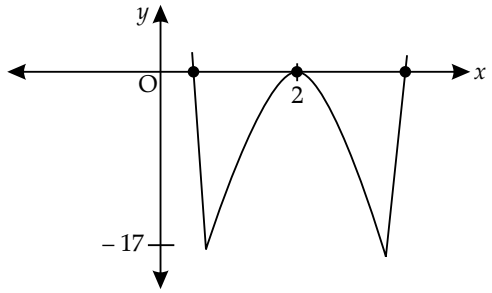
Now, the given function is $|(x-2)^2 - 17| - r$.

Hence, to give the graph of this function, the above graph should shift 'r' units below the x-axis.

Also, it is given that the function $|(x-2)^2 - 17| - r$ becomes zero at only three values of x. It means that the new graph should touch the x-axis at only three points.

Hence, the above graph must shift 17 units below the x-axis, so that the graph of $|(x-2)^2 - 17| - r$ touches the x-axis at exactly three distinct points.

Thus, the graph is as under:



The above graph represents the function of $|(x-2)^2-17|-17$

Hence, the value of r is 17.

6. Option (1) is correct.

Let the cost price of each apple, orange, and mango be denoted by a, r, and m, respectively.

According to given condition,

$$2a + 4r + 6m = a + 4r + 8m$$

$$\Rightarrow \quad a = 2m \qquad \text{...(i)}$$

Also, it is given that

$$2a + 4r + 6m = 8r + 7m$$

$$\Rightarrow 2(2m) + 4r + 6m = 8r + 7m \qquad \{\text{from (i)}\}$$

$$\Rightarrow \quad 10m + 4r = 8r + 7m$$

$$\Rightarrow \quad 3m = 4r \qquad \text{...(ii)}$$

Let the number of mangoes in the basket of mangoes be x.

According to given condition,

$$8r + 7m = x.m$$

$$\Rightarrow 2 \times (4r) + 7m = x.m$$

$$\Rightarrow 2 \times (3m) + 7m = x.m \qquad \{\text{from (ii)}\}$$

$$\Rightarrow \quad 13m = x.m$$

$$\Rightarrow \quad x = 13$$

Hence, the number of mangoes in a basket are 13.

7. Option (1) is correct.

Let the amount earned by Neeta, Geeta, and Sita in a day be n, g and s, respectively.

According to given condition,

$$n + g = 6s \qquad \text{...(i)}$$

and $$s + n = 2g \qquad \text{...(ii)}$$

Subtracting (ii) from (i), we get,

$$g - s = 6s - 2g$$

$$\Rightarrow \quad 3g = 7s$$

$$\Rightarrow \quad \frac{g}{s} = \frac{7}{3} \qquad \text{...(iii)}$$

From (i), $\quad n + g = 6s$

$$\Rightarrow \quad n + \frac{7s}{3} = 6s \qquad \{\text{from (iii)}\}$$

$$\Rightarrow \quad n = \frac{11s}{3}$$

$$\Rightarrow \quad \frac{n}{s} = \frac{11}{3} \qquad \text{...(iv)}$$

From (iii) and (iv), we can conclude that

$$n : g : s = 11 : 7 : 3$$

Hence, the ratio of the daily earnings of one who earns the most to that of the one who earns the least is 11 : 3.

8. Option (3) is correct.

Let the selling price of the small box be ₹ x.

So, as per the given condition,

the selling price of the large box = ₹$2x$

Let the selling price per gram of chocolate in the small box be ₹100.

So, as per the given condition,

the selling price per gram of chocolate in the large box = ₹88

The weight of chocolate in the small box

$$= \frac{x}{100} \text{ gm}$$

and the weight of chocolate in the large box

$$= \frac{2x}{88}$$

$$= \frac{x}{44} \text{ gm}$$

Therefore, the ratio of the weight of chocolate in the large box to the weight of chocolate in the small box $= \frac{x}{44} : \frac{x}{100}$

$$= \frac{\frac{x}{44}}{\frac{x}{100}}$$

$$= \frac{100}{44}$$

$$= \frac{25}{11}$$

Hence, the percentage by which the weight of chocolate in the large box exceeds the weight of chocolate in the small box

$$= \frac{25-11}{11} \times 100$$

$$= 1.2727 \times 100$$

$$= 127.27\%$$

$$\approx 127\%$$

9. Correct answer is [200].

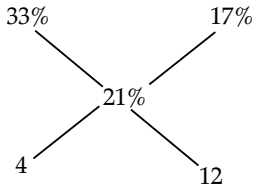
Given: The strength of an indigo solution in the first and the second bottle is 33% and 17%, respectively. Also, the total capacity of each bottle is 800 cc.

Let the solution thrown away from the first bottle be x cc.

Hence, the solution left in the first bottle = $(800 - x)$ cc

Also, the solution filled from the second bottle into the first bottle = x cc

Therefore, applying the rule of alligation, we get,



$\therefore$ The ratio of the weights of two different indigo solutions in the new mixture = 4 : 12

= 1 : 3

Now, $\dfrac{800-x}{x}=\dfrac{1}{3}$

$\Rightarrow \quad 2400 - 3x = x$

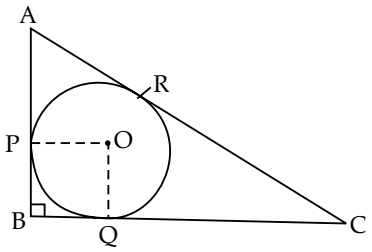
$\Rightarrow \quad x = 600$

So, the solution left in the second bottle

$= (800 - 600)$ cc

$= 200$ cc

10. Correct answer is [120].



Given: In ΔABC, $\angle ABC = 90°$ and BC = 10 inches

The circle is inscribed in ΔABC.

The diameter of the circle = d = 8 inches

Hence, the radius of the circle = r

$$= \frac{d}{2} = \frac{8}{2} = 4 \text{ inches}$$

Let the tangents AB, BC, and AC, touch the circle at the points P, Q, and R respectively.

(From the same external point, the tangent segments to a circle are equal)

Hence, BP = BQ

AP = AR

CR = CQ

Let OP and OQ be the radii of the circle

$\therefore$ OP = OQ = 4 inches

$OP \perp AB$

$OQ \perp BC$

{The radius is perpendicular to the tangent.}

Therefore, in $\square$ OPBQ, $\angle B = \angle P = \angle Q = 90°$ and OP = OQ = 4 inches

Hence, $\square$ OPBQ is a square.

$\therefore$ BP = BQ = 4 inches

CQ = BC – BQ

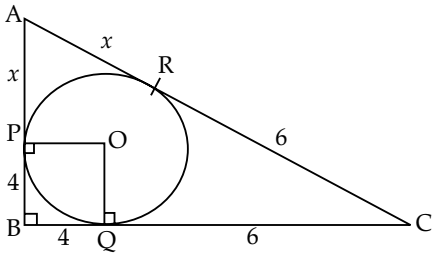
= 10 – 4

= 6 inches

CR = CQ = 6 inches

Let AP = AR = x inches

Thus, the figure becomes:



In right-angled triangle ABC, using Pythagoras theorem, we get,

$(AB)^2 + (BC)^2 = (AC)^2$

$\therefore (x + 4)^2 + (10)^2 = (x + 6)^2$

$\Rightarrow x^2 + 8x + 16 + 100 = x^2 + 12x + 36$

$\Rightarrow \quad 4x = 80$

$\Rightarrow \quad x = 20$

Perimeter of ΔABC,

P = AB + BC + AC

= (x + 4) + 10 + (x + 6)

= (20 + 4) + 10 + (20 + 6)

= 60 inches

Semi-perimeter of ΔABC,

$$S = \frac{P}{2} = \frac{60}{2} = 30 \text{ inches}$$

Area of the traingle ABC = $r \times s$,

= 4 × 30

= 120

{where r is the in-radius and s is the semi-perimeter.}

Hence, the area of ΔABC is 120 square inches.

11. Correct answer is [70].

Let the hundreds, tens, and unit digits of a three-digit number be x, y, and z respectively.

$\therefore$ The three-digit number $= x\,y\,z$

It is given that when the three-digit number is arranged in reverse order, the number increases by 198.

$\therefore$ The reverse order number $= z\,y\,x$

As per given condition,

$(100x + 10y + z) + 198 = (100z + 10y + x)$

$\Rightarrow \quad 99z - 99x = 198$

$\Rightarrow \quad z - x = 2$

The difference between z and x digits is two. Hence, the seven possible values of z and x are (9, 7), (8, 6), (7, 5), (6, 4), (5, 3), (4, 2), and (3, 1)

Also, the ten possible values of y are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Hence, the number of required three-digit numbers $= 7 \times 10$

$= 70$

12. Correct answer is [47].

Given: 1, 2, 3, 4, 5, 6, 7 and 8 are the given numbers

The groups of three or more numbers is to be selected from the given numbers such that 3 and 5 are always in the group.

3 and 5 are already selected in the group. Thus, we need to select the group of 1 or more numbers, from 1, 2, 4, 6, 7, and 8.

Also, the given condition is that 7 and 8 should never be included together in any group.

Thus, according to given condition, 1 or more numbers' group can be selected in the following ways:

One number can be selected from 1, 2, 4, 6, 7 and 8 in ${}^6C_1$ ways $= 6$ ways

The group of two numbers can be selected in

$({}^6C_2 - 1)$ ways $= \frac{6\times5}{2} - 1 = 14$ ways

The group of three numbers can be selected in

$({}^6C_3 - {}^4C_1)$ ways $= \frac{6\times5\times4}{3\times2} - 4 = 16$ ways

The group of four numbers can be selected in $({}^6C_4 - {}^4C_2)$ ways.

$= \frac{6\times5\times4\times3}{4\times3\times2} - \frac{4\times3}{2}$ ways

The group of five numbers can be selected from 1, 2, 4, 6, 7 and 8 in just 2 ways.

Hence, the required number of groups

$= 6 + 14 + 16 + 9 + 2$

$= 47$

13. Option (4) is correct.

The rates of onions for five consecutive months are ₹10, ₹20, ₹25, ₹25, and ₹50 per kg, respectively.

Let a family spends an amount of ₹100 each month, for the first three months.

Hence, the amount spent by the family for the next two months = ₹50 each month

Thus, the total amount spent by the family for five months $= 3 \times 100 + 2 \times 50$

$=$ ₹400

The onion purchaseed by the family in:

$$\text{the first month} = \frac{100}{10} = 10 \text{ kg}$$

$$\text{the second month} = \frac{100}{20} = 5 \text{ kg}$$

$$\text{the third month} = \frac{100}{25} = 4 \text{ kg}$$

$$\text{the fourth month} = \frac{50}{25} = 2 \text{ kg}$$

$$\text{the fifth month} = \frac{50}{50} = 1 \text{ kg}$$

Thus, the total quantity of onions purchased by the family in five months $= 10 + 5 + 4 + 2 + 1$

$= 22$ kg

Hence, the average expense for onion, in rupees per kg, over these five months $= \frac{400}{22}$

$= 18.18 \approx 18$

14. Option (2) is correct.

Given: $x_0 = 1$

$x_1 = 2$

$$x_{n+2} = \frac{1 + x_{n+1}}{x_n},\ n = 0, 1, 2, 3, \ldots$$

For $n = 0$, $x_{0+2} = \frac{1 + x_{0+1}}{x_0}$

$\Rightarrow \quad x_2 = \frac{1 + x_1}{x_0}$

$$\Rightarrow \quad x_2 = \frac{1+2}{1}$$

$$\Rightarrow \quad x_2 = 3$$

For $\quad x_3 = \frac{1+x_2}{x_1}$

$$\Rightarrow \quad x_3 = \frac{1+3}{2}$$

$$\Rightarrow \quad x_3 = 2$$

For $\quad x_4 = \frac{1+x_3}{x_2}$

$$\Rightarrow \quad x_4 = \frac{1+2}{3}$$

$$\Rightarrow \quad x_4 = 1$$

For $\quad x_5 = \frac{1+x_4}{x_3}$

$$\Rightarrow \quad x_5 = \frac{1+1}{2}$$

$$\Rightarrow \quad x_5 = 1$$

For $\quad x_6 = \frac{1+x_5}{x_4}$

$$\Rightarrow \quad x_6 = \frac{1+1}{1}$$

$$\Rightarrow \quad x_6 = 2$$

Thus, the values are:

$$x_0 = 1$$
$$x_1 = 2$$
$$x_2 = 3$$
$$x_3 = 2$$
$$x_4 = 1$$
$$x_5 = 1$$
$$x_6 = 2$$

From the above values, we can conclude that the pattern which is being repeated is $1 \to 2 \to 3 \to 2 \to 1$.

This pattern starts repeating from x_5. It will be again get repeated from x_{10}.

Since 2020 is a multiple of 5, the pattern will again repeat itself from x_{2020}.

Therefore, $x_{2020} = 1$

Hence, $x_{2021} = 2$

15. Correct answer is [35].

Let the number of patients admitted in hospital A be x.

$\therefore$ The number of patients admitted in hospital

$$B = x + 21$$

It is given that the sum of recovery days for patients in hospital A and B were 200 and 152, respectively.

$\therefore$ Average recovery days for patients in hospital A

$$= \frac{200}{x}$$

Average recovery days for patients in hospital B

$$= \frac{152}{x+21}$$

According to the given condition,

$$\frac{200}{x} = \frac{152}{x+21} + 3$$

$$\Rightarrow \quad \frac{200}{x} = \frac{152+3x+63}{x+21}$$

$$\Rightarrow \quad 200x + 4200 = 215x + 3x^2$$

$$\Rightarrow \quad x^2 + 5x - 1400 = 0$$

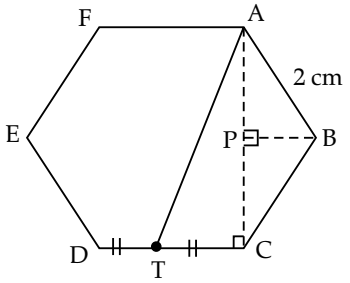
$$\Rightarrow \quad (x - 35)(x + 40) = 0$$

$$\Rightarrow \therefore \quad x = 35 \text{ or } x = -40$$

Since, the number of patients can't be negative, therefore, $x = 35$

Hence, the number of patients admitted in hospital A was 35.

16. Option (4) is correct.



Given: The length of each side of a regular hexagon ABCDEF = 2 cm

Also, T is the midpoint of CD

$$\therefore \quad \text{TC} = \frac{D2}{2} = \frac{2}{2} = 1 \text{ cm}$$

Construction: Draw the perpendicular AC on CD and BP on AC.

BC bisects $\angle$ABC

$\therefore \quad \angle ABP = \frac{\angle ABC}{2}$

$\angle ABC = 120°$ (interior angle of regular hexagon)

$\therefore \quad \angle ABP = \frac{120°}{2} = 60°$

Thus, ΔAPB is a 30°– 60° – 90° triangle

$\therefore \quad AP = \frac{\sqrt{3}}{2} \times AB = \frac{\sqrt{3}}{2} \times 2 = \sqrt{3}$ cm

BC bisects AC,

$\therefore \quad AC = 2\,AP = 2\sqrt{3}$ cm

Applying Pythagoras theorem is ΔACT, we get,

$(AT)^2 = (AC)^2 + (TC)^2$

$\Rightarrow \quad (AT)^2 = \left(2\sqrt{3}\right)^2 + 1^2$

$\Rightarrow \quad (AT)^2 = 13$

$\Rightarrow \quad AT = \sqrt{13}$ cm

Hence, the length of AT is $\sqrt{13}$ cm.

17. Option (3) is correct.

Given: Anu, Vinu and Manu can complete a work alone in 15 days, 12 days and 20 days, respectively

Anu works on days first, third, fifth and so on Manu works on days second, fourth, sixth and so on. Vinu works everyday.

Hence,

Work completed by Anu in 2 days $= \frac{1}{15}$

Work completed by Manu in 2 days $= \frac{1}{20}$

Work completed by Vinu in 2 days $= \frac{2}{12} = \frac{1}{6}$

Therefore, work completed by Anu, Manu and Vinu together in 2 days $= \frac{1}{15} + \frac{1}{20} + \frac{1}{6}$

$= \frac{17}{60}$

So, the work completed by Anu, Manu and Vinu together in 6 days $= 3 \times \frac{17}{60} = \frac{17}{20}$

$\therefore$ Remaining work $= 1 - \frac{17}{20} = \frac{3}{20}$

On seventh day, only Anu and Vinu will work. So, the work completed by Anu and Vinu together on 7th day $= \frac{1}{15} + \frac{1}{12} = \frac{3}{20}$

Hence, the number of days needed to complete the work is 7.

18. Correct answer is [99].

Given:

$$5 - \log_{10}\sqrt{1+x} + 4\log_{10}\sqrt{1-x} = \log_{10}\frac{1}{\sqrt{1-x^2}}$$

$$\Rightarrow 5\log_{10}10 - \log_{10}\sqrt{1+x} + 4\log_{10}\sqrt{1-x} = \log_{10}\frac{1}{\sqrt{1-x^2}}$$

$(\because \log_{10}10 = 1)$

$$\Rightarrow \log_{10}10^5 - \log_{10}\sqrt{1+x} + \log_{10}\left(\sqrt{1-x}\right)^4 = \log_{10}\frac{1}{\sqrt{1-x^2}}$$

$(\because a \log m = \log m^a)$

$$\Rightarrow \log_{10}\left\{\frac{10^5 \times (1-x)^2}{\sqrt{1+x}}\right\} = \log_{10}\frac{1}{\sqrt{1+x}.\sqrt{1-x}}$$

$\{\because \log m + \log n = \log (m \times n)$ and $\log m - \log n = \log (\frac{m}{n})\}$

Removing log from both sides, we get,

$$\Rightarrow \frac{10^5 \times (1-x)^2}{\sqrt{1+x}} = \frac{1}{\sqrt{1+x}.\sqrt{1-x}}$$

$$\Rightarrow \frac{10^5 \times (1-x)^2}{1} = \frac{\sqrt{1}}{(1-x)^{\frac{1}{2}}}$$

$$\Rightarrow 10^5 = \frac{1}{(1-x)^{\frac{5}{2}}}$$

Taking 5th root on both sides, we get,

$$10 = \frac{1}{(1-x)^{\frac{1}{2}}}$$

Squaring both sides, we get,

$$100 = \frac{1}{1-x}$$

$\Rightarrow \quad 100 - 100\,x = 1$

$\Rightarrow \quad -100\,x = 1 - 100$

$\Rightarrow \quad -100\,x = -99$

$\Rightarrow \quad 100\,x = 99$

19. Correct answer is [32].

Given: Amar and Akbar together complete the project in 12 months.

Akbar and Anthony together complete the project in 16 months.

Amar and Anthony together complete the project in 24 months.

Let Amar, Akbar, and Anthony complete the project in x, y, and z months respectively, when they work alone.

Amar's one month's work $= \frac{1}{x}$

Akbar's one months's work $= \frac{1}{y}$

Anthony's one month's work $= \frac{1}{z}$

Amar's and Akbar's one month's work together $= \frac{1}{x}+\frac{1}{y}$

$$\frac{1}{x}+\frac{1}{y}=\frac{1}{12} \quad ...(i)$$

Akbar's and Anthony's one month's work together $= \frac{1}{y}+\frac{1}{z}$

$$\frac{1}{y}+\frac{1}{z}=\frac{1}{16} \quad ...(ii)$$

Amar's and Anthony's one month's work together $= \frac{1}{x}+\frac{1}{z}$

$$\frac{1}{x}+\frac{1}{z}=\frac{1}{24} \quad ...(iii)$$

Adding (i), (ii), and (iii), we get,

$$2\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)=\frac{1}{12}+\frac{1}{16}+\frac{1}{24}$$

$$\Rightarrow \quad \frac{1}{x}+\frac{1}{y}+\frac{1}{z}=\frac{9}{96} \quad ...(iv)$$

Subtracting (ii) from (iv),

$$\frac{1}{x}=\frac{9}{96}-\frac{1}{16}$$

$$\Rightarrow \quad \frac{1}{x}=\frac{3}{96}$$

Subtracting (iii) from (iv),

$$\frac{1}{y}=\frac{9}{96}-\frac{1}{24}$$

$$\Rightarrow \quad \frac{1}{y}=\frac{5}{96}$$

Subtracting (i) from (iv), we get

$$\frac{1}{z}=\frac{9}{96}-\frac{1}{12}$$

$$\Rightarrow \quad \frac{1}{z}=\frac{1}{96}$$

Thus, Akbar works fastest while Anthony works slowest.

Amar is neither the fastest nor the slowest.

Amar's one month's work $= \frac{1}{x}=\frac{3}{96}$

Hence, time taken by Amar to complete the project while working alone $= x$ months

$$= \frac{96}{3} \text{ months}$$

$$= 32 \text{ months}$$

20. Option (1) is correct.

Given: $|n-60|<|n-100|<|n-20|$

where, 'n' is an integer.

It is given that $|n-60|<|n-100|$.

It means that 'n' is closer to 60 as compared to 100 on the integer line.

Thus, $n < 80$ ....(i) ($\because$ 80 is the mid-point of 60 and 100)

Also, $|n-100|<|n-20|$

It means that 'n' is closer to 100 as compared to 20 on the integer line.

Thus, $n > 60$ ...(ii)($\because$ 60 is the mid-point of 20 and 100)

From (i) and (ii), $60 < n < 80$

So, the integers 'n' that satisfy the given inequalities, range from 61 to 79.

Hence, the required number of integers 'n' is 19.

21. Option (1) is correct.

Given: During the second year, Anil receives an accrued compound interest of ₹806.25 and during the third year, he receives an accrued compound interest of ₹866.72

So, the rate of interest $= \frac{866.72-806.25}{806.25}\times 100\%$

$$= \frac{60.47}{806.25}\times 100\%$$

$$= 7.5\%$$

Hence, the interest accrued during the fourth year

$$= ₹(866.72 \times 1.075)$$
$$= ₹931.724$$

22. Option (3) is correct.

Given: The number of elements in the first group = 1

The number of elements in the second group = 3

The number of elements in the third group = 5

Thus, the number of elements in the n^{th} group

$$= 2n - 1$$

$\therefore$ The number of elements in the 15^{th} group $= 2 \times 15 - 1 = 29$

Also, the last element in the first group = 1 (i.e., 1^2)

the last element in the second group = 4 (i.e., 2^2)

the last element in the third group = 9 (i.e., 3^2)

Hence, the last element in the 15^{th} group will be 15^2 i.e., 225

Thus, the 15^{th} group consists of a series of numbers, wherein

The total numbers i.e., $n = 29$

The last element i.e., $l = 225$

$\therefore$ The first element i.e., $a = 225 - 29 + 1 = 197$

So, the 15^{th} group is an Arithmetic Progression (A.P.) in which $n = 29$, $a = 197$, and $l = 225$

Hence, the sum of the numbers in the 15^{th} group

$$= \frac{n}{2}(a+l)$$

$$= \frac{29}{2}(197+225)$$

$$= 6119$$